fcc 77

One dollar

Cromemco

Microcomputers/peripherals

THE INDUSTRY'S MOST ADVANCED MICROCOMPUTER

The New Cromemco Z-2D Computer System typifies the complete professional quality of Cromemco products.

The Z-2D is designed as a powerful but economical dedicated computer for systems work. You will find its flexibility adapts it to your job whether you're in industry, engineering, business, instrumentation, or education.

Be sure to contact us if you'd like further information about any Cromemco product.

CROMEMCO FOR QUALITY AND PERFORMANCE

Cromemco specializes in quality computers and high-performance computer support products in the microcomputer field.

These products are designed around the industry-standard S-100 computer bus.

They range from complete computer systems using the S-100 bus (see the Z-2D, Z-2 and Z-1 systems in this catalog) through add-on memory and I/O boards to system software.

Cromemco products are also compatible with other S-100 bus computers such as the Altair 8800, 8800A, or IMSAI 8080.

For applications where quality and performance count, you can depend on Cromemco.

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Z-2 Computer System

An advanced professional microcomputer

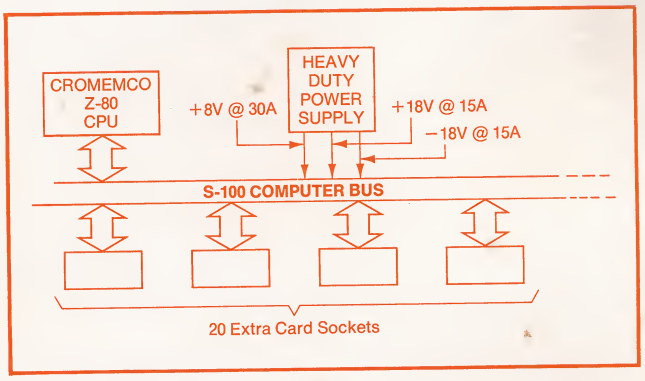
This new Cromemco Z-2 Computer System provides the engineer, businessman, educator or experimenter with the industry's fastest and most powerful microcomputer in an economical package for dedicated work.

The Z-2 makes available Cromemco's fast Z-80 microprocessor card and a 21-card motherboard in a form such that an almost endless variety of memory, I/O and other peripherals can easily be plugged in — thereby forming a computer tailored to your particular job whether in the laboratory, on the production line, or in an educational time-sharing setup.

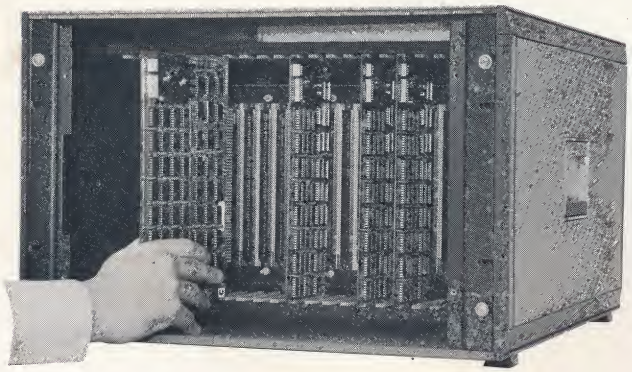
Z-2 System

Here are some of the leading features you get in the new Cromemco Z-2 Computer System:

- The industry's fastest μP board (4 MHz or 250-nanosecond cycle time).
- The power and convenience of the well-known Z-80 microprocessor chip.
- A full-length *shielded* motherboard with 21 card slots to let you plug in almost any conceivable combination of memory, I/O, or your own custom circuits.
- An extremely heavy duty power supply providing 30A from +8V and 15A from +18 and −18V. This will not only power a full set of 21 cards but also has ample additional power for other peripherals such as a floppy disk drive.



- Power-on jump circuitry to begin automatic program execution when power is turned on.
- S-100 bus — important because it is widely supported by a host of peripherals manufacturers. Thus you get the widest possible array of compatible peripherals.
- All-metal chassis and dust case.
- Card retainer that secures cards in sockets.
- Standard rack-mount style construction suited to dedicated applications. Upward compatible with larger systems. Usable with a variety of cabinets. Bench cabinet optional.
- 110 or 220-volt operation.



Full-width motherboard has slots for 21 cards.

High throughput system

The Z-2 is based on Cromemco's fast, powerful microprocessor card, the industry's only card that gives 4 MHz operation (250-nanosecond cycle time). This is about twice the speed of any other microcomputer. The speed and power of this Cromemco card are demonstrated by the fact that the Z-2 will perform real-time operations formerly done only by much larger computers.

Because the card uses the powerful Z-80 microprocessor and, in fact, uses a select one capable of 4 MHz speed, the new Z-2 with Cromemco software has up to 10 times the throughput of microcomputers based on the 8080 and previous microprocessors.

The Z-80 is widely regarded as the standard microprocessor of the future. Besides its high speed, the Z-80 offers a 158-instruction set, 19 internal registers, 10 addressing modes, and 16-bit arithmetic operations.

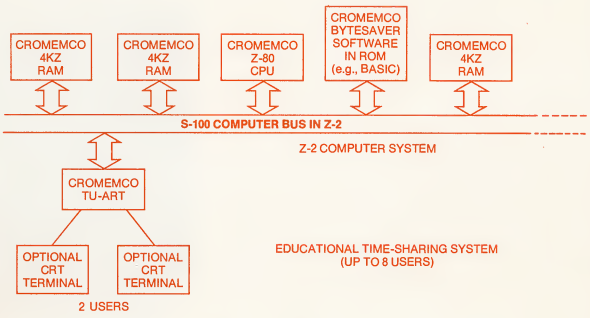
So you're in the technical fore with the Z-2. But you can also plug in other microprocessor boards if you wish.

Dedicated applications

The new Z-2 is specifically designed as a powerful but economical dedicated computer for systems work. Hence, the front panel has been made free and clear of switches and controls of any kind. This makes the Z-2 immune to accidental or incidental misadjustments of operating controls which could be troublesome and costly in dedicated applications such as industrial control.

Broad peripheral support

Cromemco offers a highly-useful array of peripherals for the Z-2 including a fast 7-channel digital-to-analog and analog-to-digital I/O, high-speed and highly-expandable memory, a PROM card *with programmer*, color graphics interface, and others.



Educational and other time-sharing

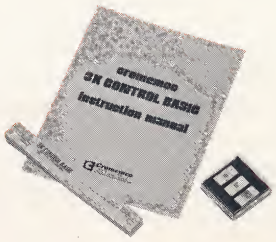
The Z-2's speed and the highly-expandable Cromemco memory boards can be combined to form a surprisingly inexpensive time-share computer which can be used by up to 8 stations.

The setup is shown in the block diagram. Entry to the computer can be through keyboard or other means into Cromemco's TU-ART digital interface card.

Cromemco's fast 4K RAM memory has a bank-select feature that allows each of up to 8 users to have an independent bank of memory. These individual banks can each have up to 64K bytes.

Although extremely simple and low-priced, this time-share computer is fast enough and powerful enough to permit 8 stations to operate with little or no waiting.

Contact Cromemco for further information.

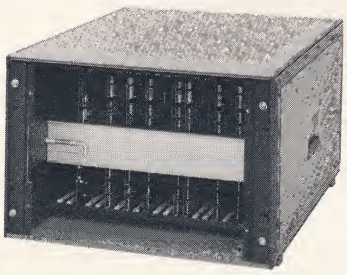


Broad software support

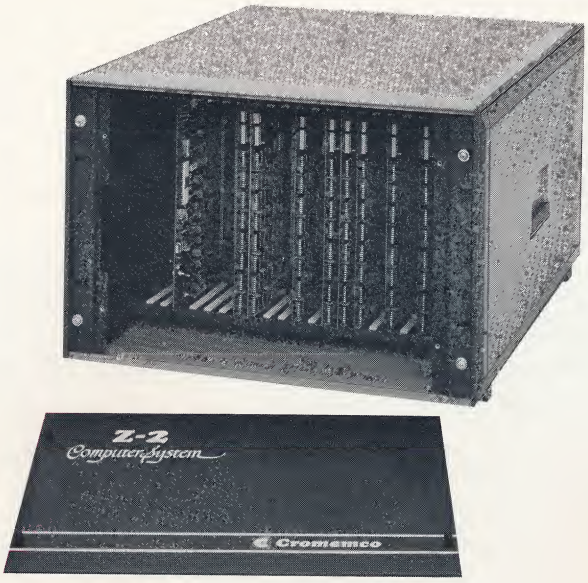
For the Z-2 Cromemco offers some of the most advanced software yet developed for microcomputers. One example is the new CONTROL BASIC interpreter which is both easy to use and powerful enough to do jobs that a full BASIC cannot. CONTROL BASIC is designed for such work as process control and automated testing.

Other Cromemco software includes a monitor and an assembler. See page 15.

Your present 8080 software can also be used with the Z-2 since the Z-80 is software-compatible with the 8080.



Heavy-duty retainer bar insures that cards won't jostle out of sockets.



Z-2 is supplied for rack mounting.
Attractive bench cabinet shown is also available.

Low noise

A number of measures have been taken in the design of the Z-2 to achieve reliable operation at its fast 4 MHz speed. Special fast memories (e.g., p. 13) have been developed, the fastest in the industry. Noise has generally been minimized, particularly on the motherboard. A unique ground-plane design has been developed, for example, that reduces ground-current noise by several dB on the bus to prevent erratic operation. This design feature is called 'Blitz-Bus'™.

Rack/Cabinet mounting

The basic Z-2 is supplied in a black-anodized metal case for mounting in a standard 19-inch relay rack. A quality stylized bench cabinet in an attractive blue color is also available.

Kit or assembled

The Z-2 is available in either kit or assembled form. The kit includes the Z-2 for rack-mounting, the Cromemco Z-80 4 MHz microprocessor card, the full-length 21-card motherboard, power supply, one card socket and card guide, and front panel.

The assembled Z-2 includes the above as well as all 21 sockets and card guides, and a cooling fan.

TECHNICAL SPECIFICATIONS
Z-2 COMPUTER SYSTEM

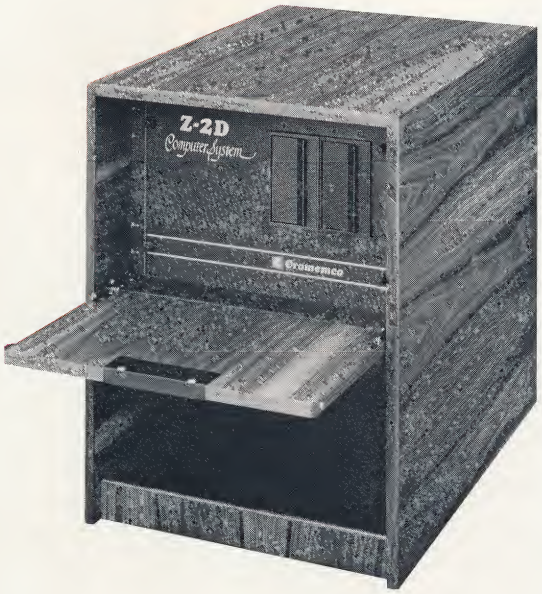
Processor: 4 MHz version Z-80
Cycle time: 250 nanoseconds
Minimum instruction execution time: 1 microsecond
Instruction set: 158 instructions including the 78 instructions of the 8080
System bus: industry standard S-100
Board capacity: 21 boards
Power supply: +8 volts @ 30A, +18 volts @ 15A, −18 volts @ 15A
Power: Operates from 110/220 volts; 50/60 cycles.
Operating environment: 0-55°C
Dimensions: 12¼" H x 19" W x 20¾" D (31.1 x 48.3 x 52.7 cm)
Weight: 39 lbs (18 kg)
Mounting: For rack mounting (optional bench cabinet available)
Price: Model Z-2K Computer System kit: $595.
Model Z-2W Computer System assembled: $995.

Data subject to change without notice
Prices fob factory

Z-2 Accessories

- CABINET. High quality all-aluminum cabinet with blue finish. Fold away handles. Outside dimensions 13" x 20" x 26". Weight 25 lbs. Model Z2-CAB: $195.
- SOCKET AND CARD GUIDES. Socket and card guides for use with Z2 21-slot motherboard. Model Z2-SCG: $8.
- FAN. Low noise cooling fan produces 52 CFM air flow. Fan comes standard with assembled Z2. Extra cost option with Z2 kit. Model Z2-FAN: $25.
- BLANK FRONT PANEL. Black-anodized blank front panel for your customized computer system. Model Z2-BFP: $35.

Z-2D Disk Computer System



On the next two pages details are given of the new Cromemco Z-2D Disk Computer System.

The Z-2D is the most advanced microcomputer system presently available and is designed for computer applications requiring up to 184 kilobytes of disk memory.

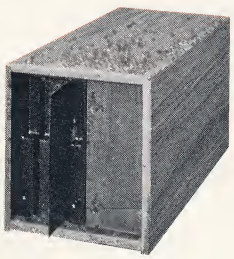
The Z-2D is a complete working system as purchased with the exception of RAM memory.

Cromemco's advanced, fast 4K and 16K RAM memories are shown on pages 12 and 13.

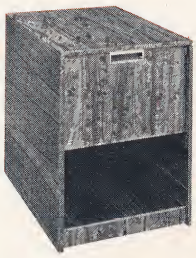
The Z-2D is supplied for rack mounting. An all-metal bench cabinet is optionally available as is an oiled-walnut floor cabinet – the latter suited to any office or professional decor.

The Z-2D is supported by Cromemco's powerful software and wide range of plug-in memory, I/O, and accessories.

Optional metal bench cabinet; see p. 6



8" dual disk drive. See p. 10



Oiled-walnut floor cabinet. Model Z2-WCB: $595

Software. See p. 22, 23

Z-2D Disk Computer System

Loading your programs and files will take you only a few seconds with the new Cromemco Z-2D computer.

You can load fast because the Z-2D comes equipped with a 5″ floppy disk drive and controller. Each diskette will store up to 92 kilobytes.

Diskettes will also store your programs inexpensively—much more so than with ROMs. And ever so much more conveniently than with cassettes or paper tape.

The Z-2D itself is our fast, rugged, professional-grade Z-2 computer equipped with disk drive and controller. You can get the Z-2D with either single or dual drives (dual shown in photo).

CROMEMCO HAS THE SOFTWARE

You can rely on this: Cromemco is committed to supplying quality software support.

For example, here's what's now available for our Z-2D users:

CROMEMCO FORTRAN IV COMPILER: a well-developed and powerful FORTRAN that's ideal for scientific use. Produces optimized, relocatable Z-80 object code.

CROMEMCO 16K DISK BASIC: a powerful pre-compiling interpreter with 14-digit precision and powerful I/O handling capabilities. Particularly suited to business applications.

CROMEMCO Z-80 ASSEMBLER: a macro-assembler that produces relocatable object code. Uses standard Z-80 mnemonics.

Optional oiled-walnut floor cabinet for Z-2D Computer System.

Model Z-2D Computer System is supplied for rack mounting. Optional bench and floor-model cabinets are available.

ADVANCED CONTROLLER CARD

The new Z-2D is a professional system that gives you professional performance.

In the Z-2D you get our well-known 4-MHz CPU card, the proven Z-2 chassis with 21-slot motherboard and 30-amp power supply that can handle 21 cards and dual floppy drives with ease.

Then there's our new disk controller card with special features:

- Capability to handle up to 4 disk drives
- A disk bootstrap Monitor in a 1K 2708 PROM
- An RS-232 serial interface for interfacing your CRT terminal or teletype
- LSI disk controller circuitry

We're able to put all of this including a UART for the CRT interface on just one card because we've taken the forward step of using LSI controller circuitry.

Z-2 USERS:
Your Z-2 was designed with the future in mind. It can be easily retrofitted with everything needed to convert to a Z-2D. Only $935 kit; or $1135 for assembled retrofit package.

RAM MEMORY

4K or 16K RAM memory cards are available for this computer.

See pp. 12 and 13 of this catalog.

STORE/FACTORY

Contact your computer store or Cromemco factory now about the Z-2D. It's a real workhorse that you can put to professional or OEM use now.

Kit: Z-2D with 1 disk drive
(Model Z2D-K) . . . . . $1495.
Assembled: Z-2D fully assembled
and tested (Model Z2D-W) . . . . $2095.

SOFTWARE

(On standard IBM-format soft-sectored mini diskettes)

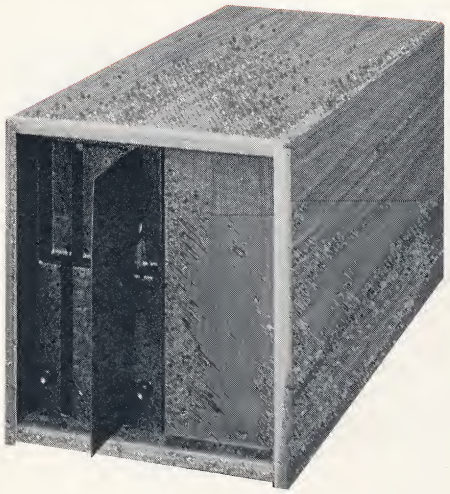
16K BASIC (Model FDB-S) $95
FORTRAN IV (Model FDF-S) $95
Z-80 Assembler (Model FDA-S) $95

TECHNICAL SPECIFICATIONS
Z-2D DISK COMPUTER SYSTEM

PROCESSOR: 4 MHz version Z-80
CYCLE TIME: 250 nanoseconds
MINIMUM INSTRUCTION EXECUTION TIME: 1 microsecond
INSTRUCTION SET: 158 instructions including the 78 instructions of the 8080
SYSTEM BUS: Industry standard S-100
BOARD CAPACITY: 21 boards
DISK DRIVE CAPACITY: 2 drives (supplied with one drive)
DISK STORAGE CAPACITY: 92K bytes each disk
PROM FIRMWARE: 1K bytes (2708 PROM)
SERIAL INTERFACE: RS-232 or current loop; 110 to 76,800 baud
PARALLEL INTERFACE: 8 bit TTL levels
POWER SUPPLY: +8 volts @ 30A, +18v @ 15A, -18v @ 15A
POWER: operates from 110/220 volts; 50/60 cycle
OPERATING ENVIRONMENT: 0 -55°C
DIMENSIONS: 12 1/4" H X 19" W X 20 3/4" D (31.1 X 48.3 X 52.7 cm)
WEIGHT: 49 lbs (22 kg)
MOUNTING: For rack mounting (optional cabinets available)
PRICE: Model Z2D-K Disk Computer System Kit: $1495
Model Z2D-W Disk Computer System Assembled: $2095

Data subject to change without notice
Prices fob factory

Dual Disk Drive



Here is a convenient unit for situations that require 8" dual disks. This is a dual Persci floppy disk drive complete with case, power supply and cables to connect to the S-100 bus interface in our 4FDC Controller Card (used in the Z-2D computer).

Use with Cromemco Disk Controller Card Model 4FDC (see p. 20).

Drive is supplied in oiled walnut cabinet shown.

PRICES

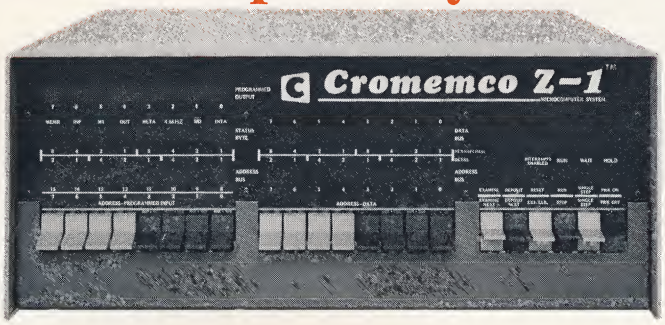
8" Dual Floppy Disk Drive kit (Model PFD-K) $1995
8" Dual Floppy Disk Drive assembled (Model PFD-W) $2495

Disk Controller card kit (Model 4FDC-K). $395
Disk Controller card assembled (Model 4FDC-W) $595

SOFTWARE

Purchasers of above drive may purchase software on 8" floppy disks as follows:
16K BASIC (Model FDB-L) $95
FORTRAN IV (Model FDF-L). . . $95
Z-80 Assembler (Model FDA-L) . . $95
Dazzler Games (Model FDG-L). . . $95

Z-1 Computer System



μP development system

In addition to being a powerful microcomputer the Z-1 is a major **μP development system.** It will give you a big head start in developing **your circuits** around the Z-80 μP.

All you need do is plug your breadboards into the Z-1's 17 or more extra sockets. You're right into the computer bus.

Broad "S-100" support

What's more, the Z-1 offers you all kinds of peripherals and software. It uses the standard "S-100" bus supported by over a dozen manufacturers. And all Cromemco peripherals (PROM memory and programmer, RAM memory, analog I/O, color TV interface, etc.) just plug into the Z-1's extra sockets.

Cromemco also provides complete software support: a monitor, assembler, BASIC interpreter and more to come soon.

Not a kit

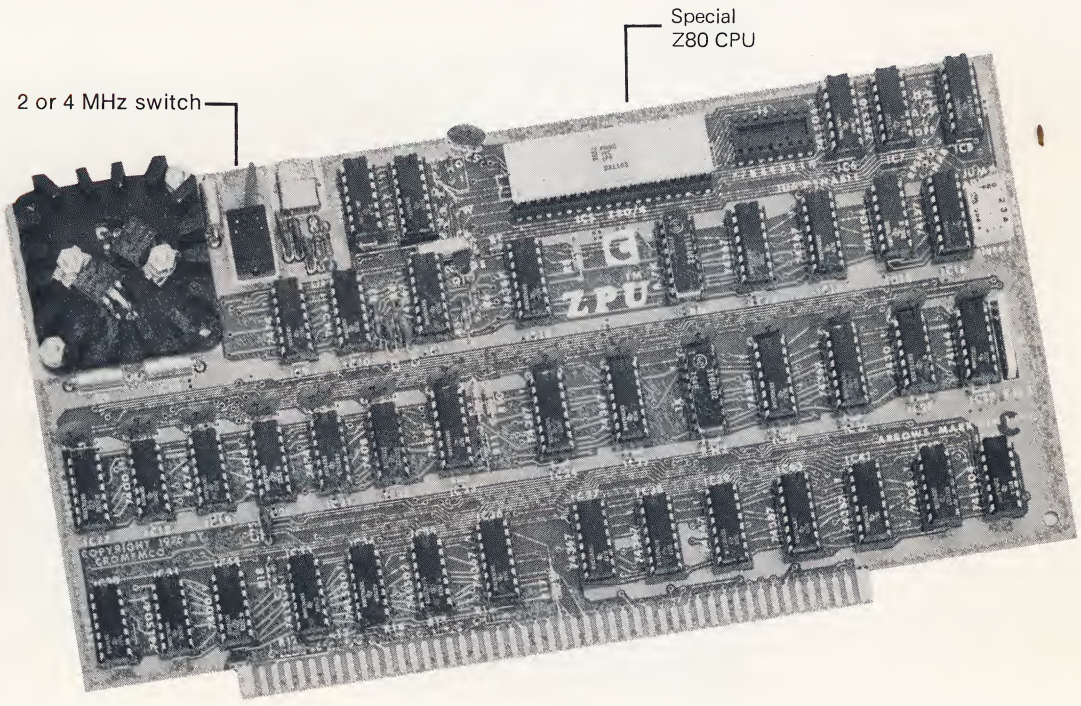
The Z-1 comes completely assembled and tested. It's a quality, commercial-grade microcomputer. It is not available as a kit. Just plug it into the 110-volt line and you're ready to go.

TECHNICAL SPECIFICATIONS Z-1 COMPUTER SYSTEM

PROCESSOR: 4 MHz version Z-80.
CYCLE TIME: 250 nanoseconds.
MINIMUM INSTRUCTION EXECUTION TIME: 1 microsecond.
INSTRUCTION SET: 158 instructions including the 78 instructions of the 8080.
SYSTEM BUS: industry standard S-100.
BOARD CAPACITY: 21 boards.
FRONT PANEL CONTROLS: Examine, Examine Next, Deposit, Deposit Next, Reset, External Clear, Run, Stop, Single Step. Power on/off.
FRONT PANEL DISPLAY: 16-bit address, 8-bit data, 8-bit programmed output port.
RAM MEMORY: 16K bytes.
I/O INTERFACE: RS-232.
PROM CAPACITY: 8K bytes.
PROM PROGRAMMER: programs 2708 PROMs.
RESIDENT MONITOR: 1K bytes.
POWER SUPPLY: +8 volts @ 28 A, + 18 volts @ 2A, −18 volts @ 2 A.
POWER: Operates from 110 volts; 50/60 cycle.
OPERATING ENVIRONMENT: 0 − 55°C.
DIMENSIONS: 7" H x 19-1/2" W x 17" D (17.8 x 49.5 x 43.2 cm).
WEIGHT: 35 lbs (15.9 kg).
MOUNTING: for bench-top use.
PRICE: $2995

Cromemco

4 MHz CPU card



- Uses special Z80 microprocessor
- Fast—4 MHz clock rate
- Does not require front panel for operation

2–5X MORE THROUGHPUT

Here is by far the most powerful CPU card now available. (It is the heart of our Z1 and Z2 computers.)

It's Cromemco's new Z80-CPU card.

It uses the slick new Z-80 chip—in fact, it uses a special high-speed version of the Z-80—and it's the *only* card that does. This special Z80 is certified by its manufacturer for 4 MHz operation.

The Z80 has all the advantages of the 8080 and 6800—and enormously more.

And Cromemco's new Z80-CPU card does enormously more.

4 MHz CLOCK RATE

First, this CPU lets you choose either a 2 or 4 MHz crystal-controlled clock rate. Right away that means you can have twice the throughput. Cuts program running time in half. Then the instruction set of the Z80 reduces software even more.

The 2 or 4 MHz clock rate is switch-selectable as shown in the above photo.

POWER-ON MEMORY JUMPS

Cromemco's CPU also has some neat design innovations of its own.

For example, you'll like the simplified operation you get because upon power turn-on the CPU will jump to any desired 4K boundary in memory. No switch flipping to go through to begin your program. So you can also use this CPU card in stand-alone systems—and it can be operated without need of a front panel.

80 ADDITIONAL INSTRUCTIONS

You've probably heard that the Z-80 with its 80 new additional instructions is by far the most powerful chip around. It's true.

That means with our CPU you will be able to devise much more powerful (as well as faster) software than before.

ALTAIR/IMSAI COMPATIBLE WITHOUT MODIFICATION

Yes, the new CPU is plug-compatible with the Altair 8800, 8800A, and IMSAI 8080. Just remove the existing CPU, plug in the Z80/CPU, and you're up and running.

Further, the Cromemco CPU is the only card guaranteed to work with all present and future Cromemco peripherals. (Cromemco manufactures the popular BYTESAVER™ memory, the TV DAZZLER™, the D + 7A™ analog interface board, a joystick console, and others.

INCLUDES FREE SOFTWARE

The CPU comes with our powerful Z-80 monitor, complete documentation, source code, and paper tape object code. The monitor is also available in PROM ($50) for use in our BYTESAVER or 16 KPR memory boards.

KIT/ASSEMBLED

The new ZPU is available as a kit or assembled. Look into it now.

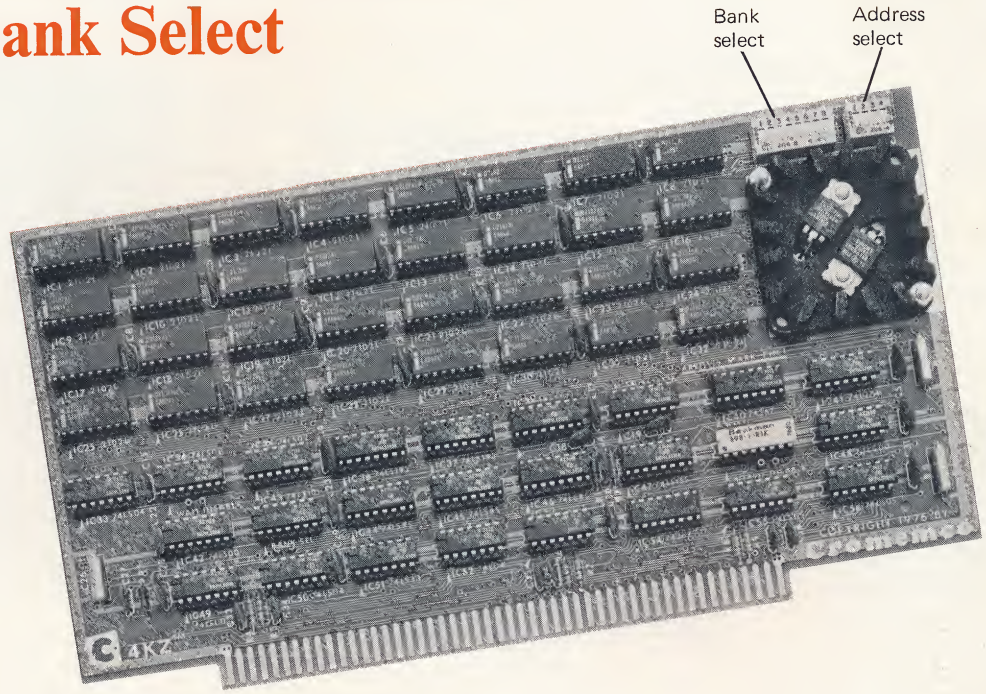
Z80-CPU kit (Model ZPU-K) . . . $295

Z80-CPU assembled
(Model ZPU-W) $395

TECHNICAL SPECIFICATIONS Z-80 MICROPROCESSOR CARD

PROCESSOR: 4 MHz version of the Z-80.
CLOCK RATE: 2/4 MHz (switch selectable).
INSTRUCTION SET: 158 instructions including the 78 instructions of the 8080.
POWER-ON JUMP: jumper wire enabled.
POWER-ON JUMP LOCATIONS: 16 locations switch selectable.
WAIT STATE GENERATION: 0 - 4 wait states jumper wire selectable.
M1 WAIT STATE: jumper wire selectable.
BUS: S-100.
POWER REQUIREMENTS: +8 volts @ 1.1 A.
OPERATING ENVIRONMENT: 0 - 55°C.

4K RAM card with address anticipation and Bank Select



- For S-100 bus computers

See information about Memory Bank Select on p.13

You probably know our Z-80 CPU card. It's the finest and most powerful card available. Not only does it have a guaranteed speed of 4 MHz and a crystal-controlled 2/4 MHz clock rate, **it also has a power-on memory jump feature** that greatly simplifies starting-up.

Now we've developed an outstanding 4K RAM memory card for this CPU card (or for any S-100 bus CPU card). **Our new Model 4KZ is a static memory that has:**

(1) a guaranteed speed of 4 MHz
(2) a memory-bank-select feature.

As you would expect with a Cromemco product, this new Model 4KZ gives you advanced performance at low cost. It achieves its 4 MHz speed while using proven, reliable, low-power memory chips (21L02's). How? By a novel design that uses address anticipation.

ENORMOUSLY EXPANDABLE

You get staggering expandability in the new 4KZ — to 512 kilobytes if you'd like.

Here's how: with the 4KZ you can organize memory into as many as 8 banks of 64K bytes each.

Then an 8-position switch on the 4KZ selects a given bank.

With memory expandability like that, Cromemco's CPU and RAM cards are the basic hardware for a broad range of jobs — even jobs that until now were only for large computers.

LOW PRICED

The new 4KZ has the high quality Cromemco is known for. It is available at computer stores — or directly from the factory.

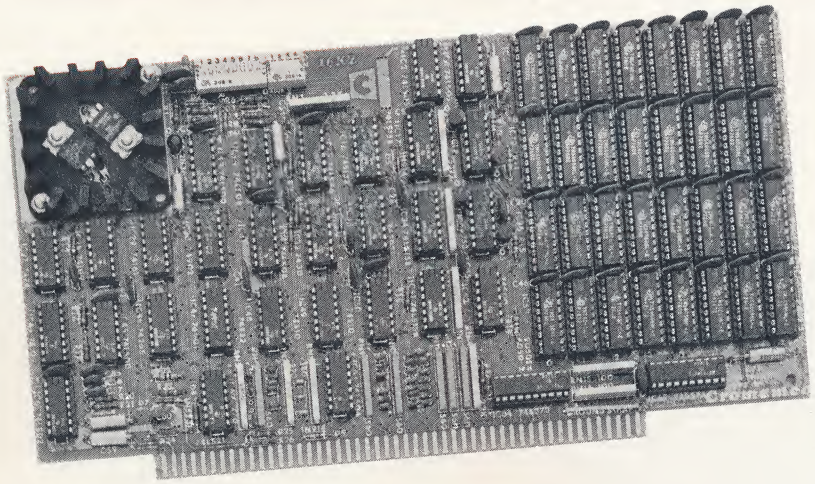
Just a word of caution. The 4KZ is bound to be in demand, so we suggest you act promptly.

4K Static RAM Memory kit (Model 4KZ-K) . . . $195
4K Static RAM Memory assembled, burned-in and tested (Model 4KZ-W) $295

TECHNICAL SPECIFICATIONS
4KZ RAM

MEMORY CAPACITY: 4K bytes.
MEMORY TYPE: 21L02 RAM.
MEMORY ACCESS TIME: 450 nanoseconds.
WAIT STATES AT 2 MHz: none required.
WAIT STATES AT 4 MHz: on non-sequential addresses only.
BUS: S-100.
POWER REQUIREMENTS: +8 volts @ 0.8 A.
OPERATING ENVIRONMENT: 0 – 55°C.

16K RAM card with Bank Select



- The fastest available
- No wait states required at either 2 or 4 MHz operation
- Offers expandability to a half megabyte with Bank Select
- Can be used for time-sharing (up to 8 users)
- Dynamic refresh fully transparent

FAST, EXPANDABLE

Not only is this the fastest 16K RAM card available but it is expandable to a half megabyte.

It will operate at 4 MHz with no wait states.

TIME SHARING

One of the best examples of the power of the Bank-Select feature is that it will let you achieve a time-share system with minimum software overhead.

Each user (there can be up to 8) will be confined to his own bank of memory.

S-100 BUS COMPATIBILITY

This memory can be plugged into any S-100 bus computer. That includes the Cromemco Z-1 and Z-2, the Altair 8800, the IMSAI 8080, and others.

START WITH THE BEST

Sooner or later you'll inevitably want larger memory. So start with Cromemco and be sure you'll have the expandability and high-speed performance you'll need.

PRICES

16K RAM Memory kit (Model 16KZ-K) $495

16K RAM Memory assembled, burned-in and tested (Model 16KZ-W) $795

TECHNICAL SPECIFICATIONS 16KZ RAM CARD

MEMORY CAPACITY: 16K bytes.
MEMORY TYPE: 4050-2 RAM.
MEMORY ACCESS TIME: 200 nanoseconds.
WAIT STATES AT 2 MHz: none required.
WAIT STATES AT 4 MHz: none required.
BUS: S-100.
POWER REQUIREMENTS: +8 volts @ 0.8 A
+18 volts @ 0.5 A
-18 volts @ 10 mA
OPERATING ENVIRONMENT: 0 - 55°C.

MEMORY BANK SELECT

Memory bank select is a feature incorporated on Cromemco memory boards that allows the expansion of memory space beyond 64K bytes. With bank select, memory space may be organized into 8 banks of 64K bytes each for a total of one-half megabyte memory.

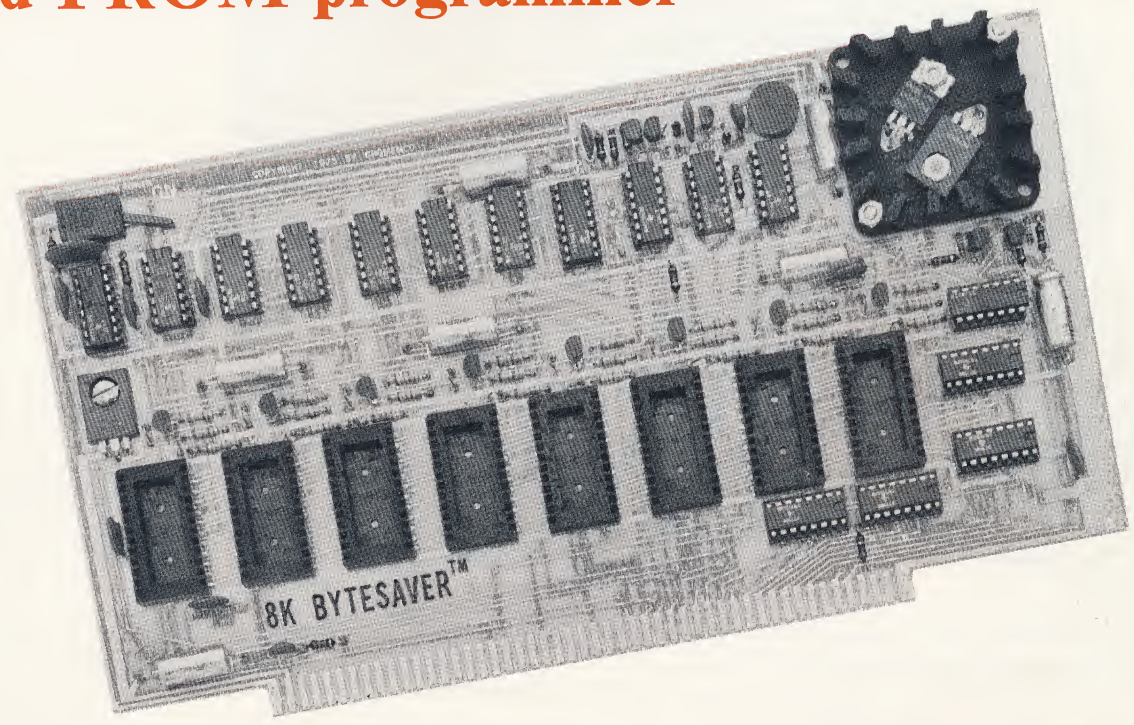
With bank select each memory board may reside in one or more of the 8 possible memory banks. An 8-position DIP switch on the board is used to select each of the banks in which the board resides.

The active bank or banks of memory are selected under software control. Output port 40H is dedicated to this function. Each of the 8 bits of data of output port 40H are used to turn on or off the corresponding bank of memory. A "1" in the corresponding bit position will turn on the memory bank. A "0" will turn it off. All circuitry required to detect the output of port 40H is included on the memory card itself.

Bank select provides a convenient method by which to expand system memory space beyond 64K. Bank select also permits the implementation of time-sharing systems with a minimum of software overhead – up to 8 users can use the system simultaneously with each confined to his own bank of memory.

Cromemco

BYTESAVER memory board and PROM programmer



Cromemco's popular BYTESAVER™ memory board gives you two of the most-wanted features in microcomputer work:

(1) a simple, easy way to store your computer programs in programmable read only memory (PROM).

(2) A PROM memory board with the capacity for a full 8K bytes of PROM memory storage.

ECONOMICAL

The BYTESAVER™ is both a place and a way to store programs economically. It transfers programs from the non-permanent computer RAM memory to the permanent PROM memory in the BYTESAVER™. Once your program is in the BYTESAVER™, it's protected from power turn-offs, intentional or accidental. The PROMs used with BYTESAVER™ are UV erasable and can be used again and again.

The BYTESAVER™ itself plugs directly into your Altair 8800 or IMSAI 8080 and of course into the Cromemco Z1 and Z2.

PROM PROGRAMMER

Many people are surprised to learn that in the BYTESAVER™ you also have your own PROM programmer. But it's so. And it saves you up to hundreds of dollars, since you no longer need to buy one separately.

The built-in programmer is designed for the 2708 PROMs. The 2708 holds 1K bytes, four times the capacity of the well-known older 1702 PROM (yet cost-per-byte is about the same). The 2708 is also fast – it lets your computer work at its speed without a wait state. And it's low-powered. With 2708's in all 8 sockets, the BYTESAVER™ still draws only about 500 mA from the +8V bus. A complement of 2708 PROMs gives the BYTESAVER™ its full 8K capacity.

RESIDES IN MEMORY

Note that the BYTESAVER™ board resides in memory space. Thus PROMs can be programmed using conventional memory-write instructions.

HOLDS LARGE PROGRAMS

The BYTESAVER's™ 8K-byte capacity lets you store the larger and more powerful programs. 8K BASIC, for example, easily fits in the BYTESAVER™ capacity of 8 PROMs. One 1K PROM will hold the Cromemco Z-80 monitor.

AVAILABLE NOW – STORE/MAIL

BYTESAVER™ kit
(Model BSK-O) $145
BYTESAVER™ assembled
(Model BSW-O) $245
PROMs are not included with BYTESAVER™. 2708 PROMs are available at $50 each.

TECHNICAL SPECIFICATIONS BYTESAVER

MEMORY CAPACITY: 8K bytes.

MEMORY TYPE: 2708 PROM or equivalent.

MEMORY ACCESS TIME: 450 nanoseconds.

WAIT STATES AT 2 MHz: none required.

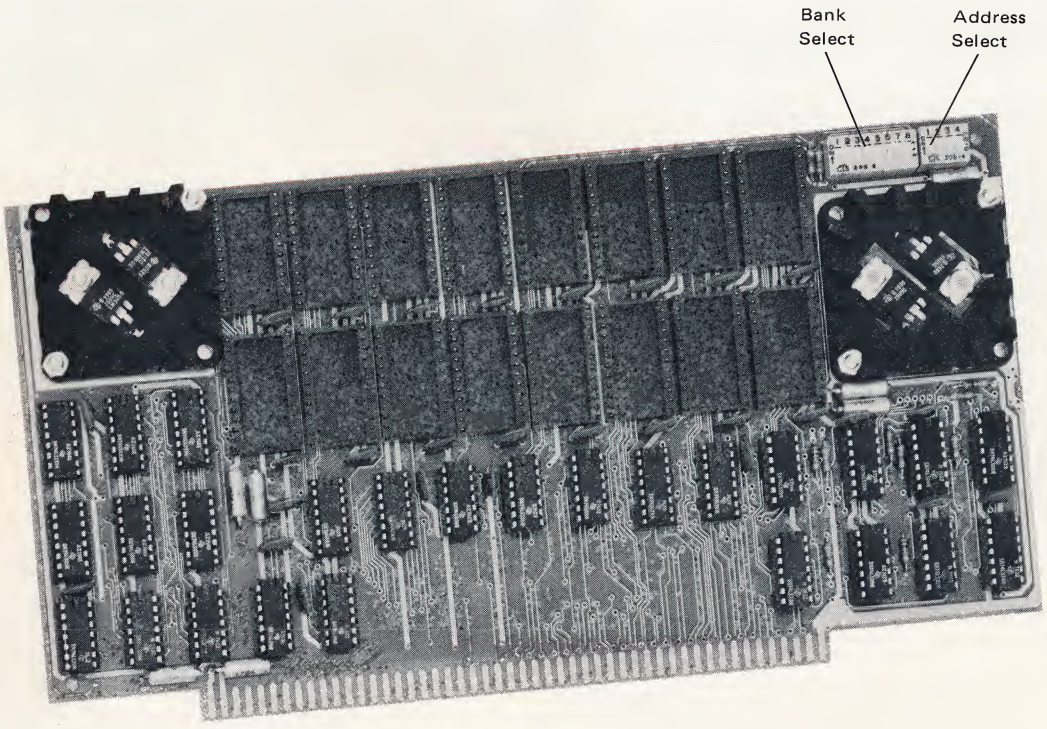
WAIT STATES AT 4 MHz: one per machine cycle.

BUS: S-100.

POWER REQUIREMENTS: +8 @ 0.5 A
+18 @ 0.4 A
-18 @ 0.2 A

OPERATING ENVIRONMENT: 0 – 55°C.

16K PROM card with address anticipation and Bank Select



HOLDS UP TO 16 HIGH-SPEED, ERASABLE 2708 PROMs

Here's what you need when you want the capability for a sizable PROM memory.

The 16KPR holds up to 16 type 2708 or equivalent PROMs (You can program these with the BYTESAVER discussed on p. 8).

The board plugs into your Altair 8800 or IMSAI 8080 as well as the Cromemco Z-1 or Z-2.

BANK SELECT

And the 16KPR has our bank-select feature. That lets the board be part of large memory systems of up to 8 banks of 64K each. See additional information on p. 13.

FAST

The 16KPR will operate with the fastest microcomputers because of its address anticipation feature. This means that there are no wait states required in the usual sequential addressing type of operation.

See information about Memory Bank Select on p. 13

PRICES

16K PROM card kit (Model 16KPR-K) $145
16K PROM card assembled (Model 16KPR-W) . $245
Proms not included
2708 PROMs available at $50 each

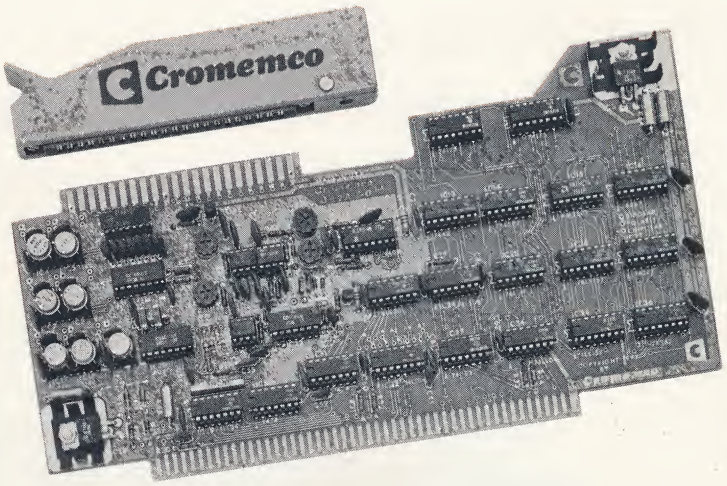
TECHNICAL SPECIFICATIONS 16KPR PROM CARD

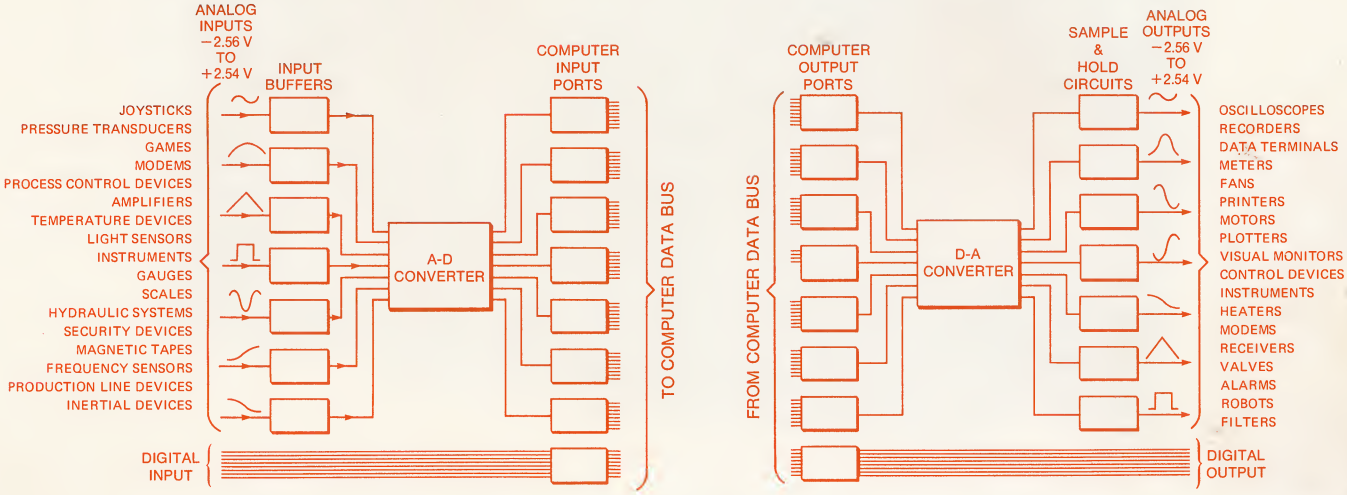
MEMORY CAPACITY: 16K bytes.
MEMORY TYPE: 2708 PROM or equivalent.
MEMORY ACCESS TIME: 450 nanoseconds.
WAIT STATES AT 2 MHz: none required.
WAIT STATES AT 4 MHz: on non-sequential addresses only.
BUS: S-100.
POWER REQUIREMENTS: +8 volts @ 0.4 A
+18 volts @ 0.8 A
-18 volts @ 0.5 A
OPERATING ENVIRONMENT: 0 - 55°C.

Cromemco

D+7AI/O™ Multi-channel microcomputer analog interface

See p. 14 for special joystick console with audio output. Use with this analog I/O.





Now you have a way to get analog information into and out of your microcomputer. It's an easy, fast, and unbelievably inexpensive way.

It's Cromemco's new D+7A™ high-performance I/O module which gives you:

- 7 channels of 8-bit analog-to-digital conversion (to input analog data to the computer)
- 7 channels of digital-to-analog conversion (to output computer data in analog form)
- an 8-bit parallel I/O port to input and output data in digital form.
- a fast conversion time of 5.5 microseconds.

A MULTITUDE OF USES

The D+7A makes it easy to use your computer for the jobs you want it to do—such as process control, digital filtering, games, oscilloscope graphics, speech recognition, speech and music synthesis.

The D+7A lets you input and output analog data with all sorts of devices: joystocks, ham radio gear, measurement instruments, machine tools, transducers, control systems, motors, recorders, and plotters, to name just a few.

NO FURTHER SOFTWARE NEEDED

The D+7A I/O plugs directly into the Altair 8800 or IMSAI 8080 microcomputers. Analog signal range is from -2.56 to +2.54 volts (20-millivolt increments) on both input and output sides.

Simple "Input" and "Output" instructions initiate A/D conversion and read in or out the ensuing 8 bits of data. No further software is required.

During conversion the D+7A holds down the computer "Ready" line.

LOW-PRICED

D+7A I/O kit
(Model D+7A-k) $145
D+7A I/O assembled
(Model D+7A-W). $245
Each D+7A includes a connector to connect to the 8 input and 8 output ports.

TECHNICAL SPECIFICATIONS D+7A A/D & D/A INTERFACE

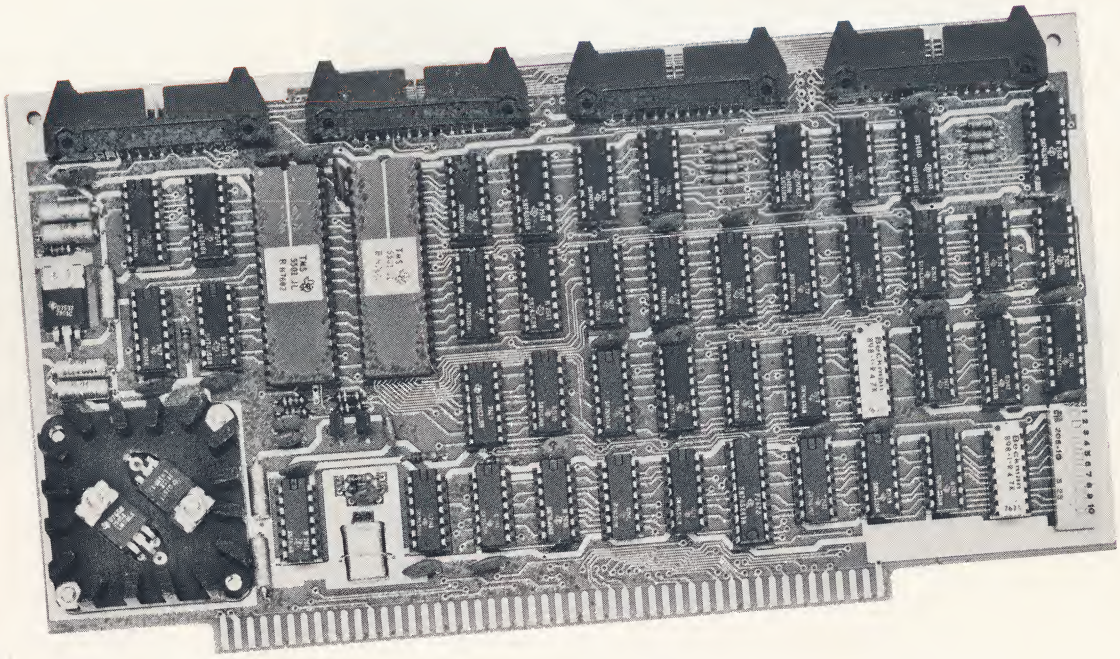
ANALOG INPUT PORTS:
- Number of input ports: 7
- Input voltage range: -2.56 to +2.54 volts
- Input bias current: 2 microamps max.
- Input impedance:
  - 20 Megohms ‖ .001 μF, 1 kHz sample rate.
  - 2 Megohms ‖ .001 μF, 10 kHz sample rate.
- Resolution: 8 bits.
- Conversion time: 5.5 microseconds
- Accuracy: ±20 millivolts

ANALOG OUTPUT PORTS:
- Number of output ports: 7
- Output voltage range: -2.56 to +2.54 volts
- Output impedance: 0.25 ohm.
- Maximum load current: 1.5 mA
- Resolution: 8 bits
- Conversion time: 5.5 microseconds
- Accuracy: ±20 millivolts
- Drift rate: Less than 10 mV/sec at 25°C

PARALLEL I/O PORT:
- Input port: 8 bits
- Output port: 8 bits
- Input load: one TTL equivalent
- Output drive: 10 TTL loads

GENERAL INFORMATION:
- Bus: S-100.
- Power requirements:
  - +8 volts @ 0.4 A
  - +18 volts @ 30 mA
  - -18 volts @ 60 mA

TU-ART digital interface with many features



For interfacing with

- CRT terminals
- line printers
- modems
- other devices

FAST – SOFTWARE SELECTABLE BAUD RATES UP TO 76,800 BAUD.

Here's a very convenient interface to let you couple not to one but to two terminals or other devices. So we call it a TU-ART.

It has two serial I/O ports, two 8-bit parallel I/O ports, and 10 independent, programmable interval timers.

Baud rates are software-selectable from 110 to 76,800 baud.

VECTORED INTERRUPTS

Yet another special convenience of the TU-ART is its vectored prioritized interrupts. Is able to support powerful vectored interrupt structure of the Z-80 microprocessor.

INTERVAL TIMERS

The 10 interval timers, since they have real-time clock capability, offer a very wide range of control possibilities.

Each timer range is from 0 - 16.32 milliseconds and is software selectable.

PRICES

TU-ART kit (Model TRT-K) $195
TU-ART assembled (Model TRT-W) $295
TU-ART Cable; up to 4 required
(Model TRT-CBL) $15

CABLES

For coupling TU-ART ports to DB-25 inputs
Model TRT-CBL cable . . . . . .$15 each
(up to 4 req'd.)

TECHNICAL SPECIFICATIONS TU-ART DIGITAL INTERFACE

SERIAL I/O PORTS:
- Number of ports: 2.
- I/O levels: RS-232 or 20 mA current loop.
- Low baud range: 110 - 9600 baud (software selectable)
- High baud range: 880 – 76,800 baud (software selectable)

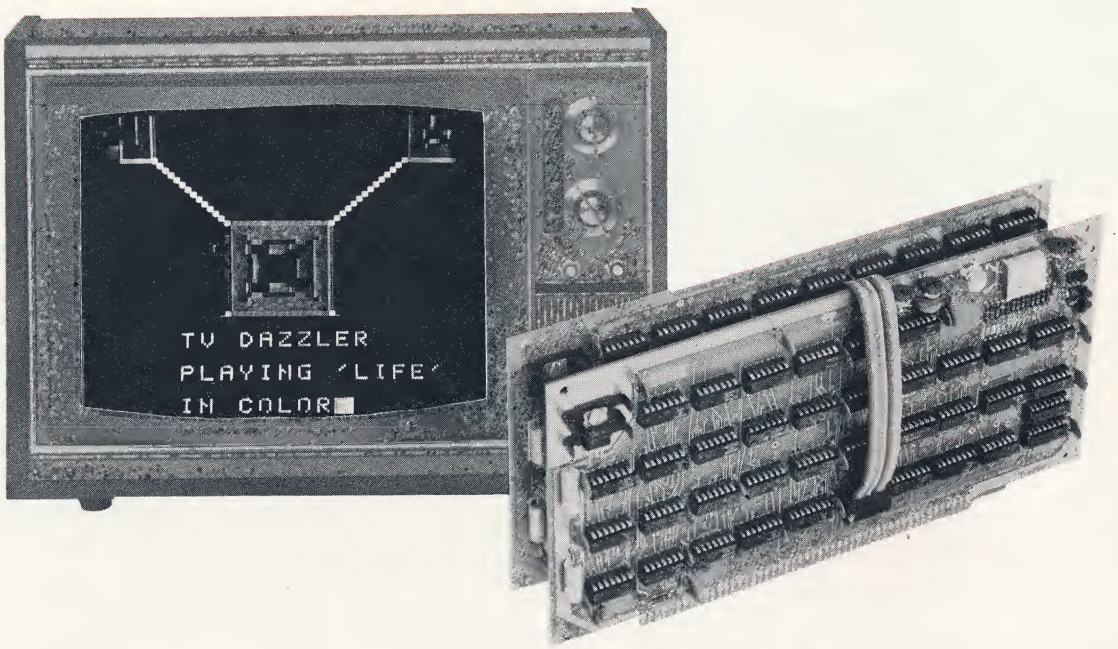
PARALLEL I/O PORTS:
- Number of ports: 2
- Input ports: 8 bits
- Output ports: 8 bits
- Input load: one TTL equivalent
- Output drive: 20 TTL loads

INTERVAL TIMERS:
- Number of timers: 10
- Timer range: 0 – 16.32 msec (software selectable).
- Timer resolution: 64 microseconds

VECTORED INTERRUPTS:
- Number of restart locations (8080 mode): 8
- Number of restart locations (Z-80 mode): 65,536
- Prioritization of TU-ART ports: internally prioritized
- Prioritization for multiple TU-ARTs: daisy-chaining

GENERAL INFORMATION:
- UART type: 5501
- Bus: S-100
- Power requirements: +8 volts @ 1.0 A
  +18 volts @ 80 mA
  -18 volts @ 40 mA
- Operating environment: 0 – 55°C.

TV Dazzler



TV Dazzler [tm]

. . . a microcomputer interface
that lets a color TV
be your computer display terminal

- **inexpensive**
- **unbelievably versatile**
- **beautiful displays of computer games**
- **for hobbyists**
- **for engineers**
- **for educators**
- **for business**

Cromemco's new computer/tv interface circuit lets you have a full-color computer display terminal for little more than a black-and-white terminal.

The Cromemco interface also lets you do vastly more with your color terminal than you can do with ordinary black-and-whites.

We call our interface the TV Dazzler[tm]. It consists of two circuit boards that plug directly into your Altair 8800 or IMSAI 8080 computer.

ALPHANUMERICS PLUS ACTION, AND GRAPHICS

The Dazzler[tm] maps your computer memory content onto your color tv screen in full color.

That doesn't mean just that you see alphanumerics in color. You can display *any* information in memory. And do so in color.

NEEDS ONLY 2K MEMORY

Technically, the Dazzler[tm] scans your computer memory using direct-memory access (DMA). It formats each memory bit into a point on the tv screen to give a 128 x 128-element picture. Only a 2K-byte computer memory is required (only 512 bytes for a 32 x 32 picture). The quality of the pictures is evident in the photos.

The Dazzler[tm] output is a video signal that goes directly to the tv video amp or to the antenna terminal through an inexpensive commercially-available device.

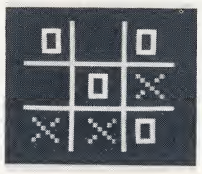
INEXPENSIVE — AND SO MUCH BETTER

You can see from the list below that the Dazzler[tm] is little if any more in price than an ordinary b/w interface or tv typewriter. But it does much more.

TV display pattern obtained during a sequence of the computer game LIFE from Cromemco software (below). Display is in beautiful color.

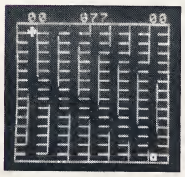
Example using Cromemco's DAZZLE-MATION software. A second tape ("Magenta Martini") was used to obtain above action display. This tape is included with DAZZLE-MATION as a use example.

Top four lines show range and style of alphanumerics obtainable with Cromemco's DAZZLE-WRITER software. Query lines are first two prompts from MITS BASIC.

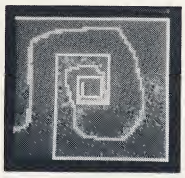


Sequence from Cromemco's TIC-TAC-TOE software which lets you play the computer. Don't be sure you'll always win—we've made it rough.

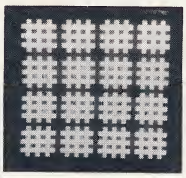
Sequence from Cromemco's KALEIDOSCOPE software. This program runs without keyboard entry, gives you stunning color display.



CHASE
2 persons, 2 joysticks. Cross chases circle while vertical bars move.

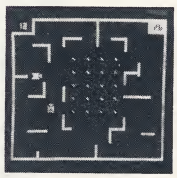


TRACK
1 person, 1 joystick. Move the dot to center of spiral without touching spiral arms.



4-D TIC-TAC-TOE
Let's see you play 4-dimensional TIC-TAC-TOE.

SPACE WAR
Try zapping your opponent with or without sun gravity.



TANK WAR
And here it is — the great TANK WAR.

MANY OF THE ABOVE ARE BEAUTIFUL COLOR DISPLAYS ON THE TV SET

TECHNICAL SPECIFICATIONS DAZZLER

DISPLAY FORMAT: 128 x 128, 64 x 64, or 32 x 32 (software selectable).
COLORS AVAILABLE (COLOR MODE): Red, green, blue, cyan, magenta, yellow, white, black.
GRAY-SCALE AVAILABLE (B&W MODE): 16 intensities.
SYSTEM MEMORY REQUIRED: 2K bytes (512 bytes for low resolution mode).

MEMORY ACCESS: DMA.
DMA RATE: 1 Megabyte/second.
VIDEO OUTPUT: Composite video TV signal.
BUS: S-100 (two slots required).
POWER REQUIREMENTS: +8 volts @ 1.4 A
-18 volts @ 50 mA
OPERATING ENVIRONMENT: 0 - 55°C.

DISPLAYS IN COLOR

You can display computer games or animated shows (rocket ships). What's more, you can display business or technical graphics — multi-colored charts, graphs, histograms, educational material — all from computer memory. Even light shows. Not even the biggest computer manufacturers offer all this in color.

DAZZLER SOFTWARE
(punched paper tape with documentation)

If you're into computer (or want to be), if you want to invent these beautiful displays or games, or to plot colorful material inexpensively at home or in business, the Dazzler[tm] is for you.

Not only is it reasonable, but it's sold at computer stores from coast to coast.

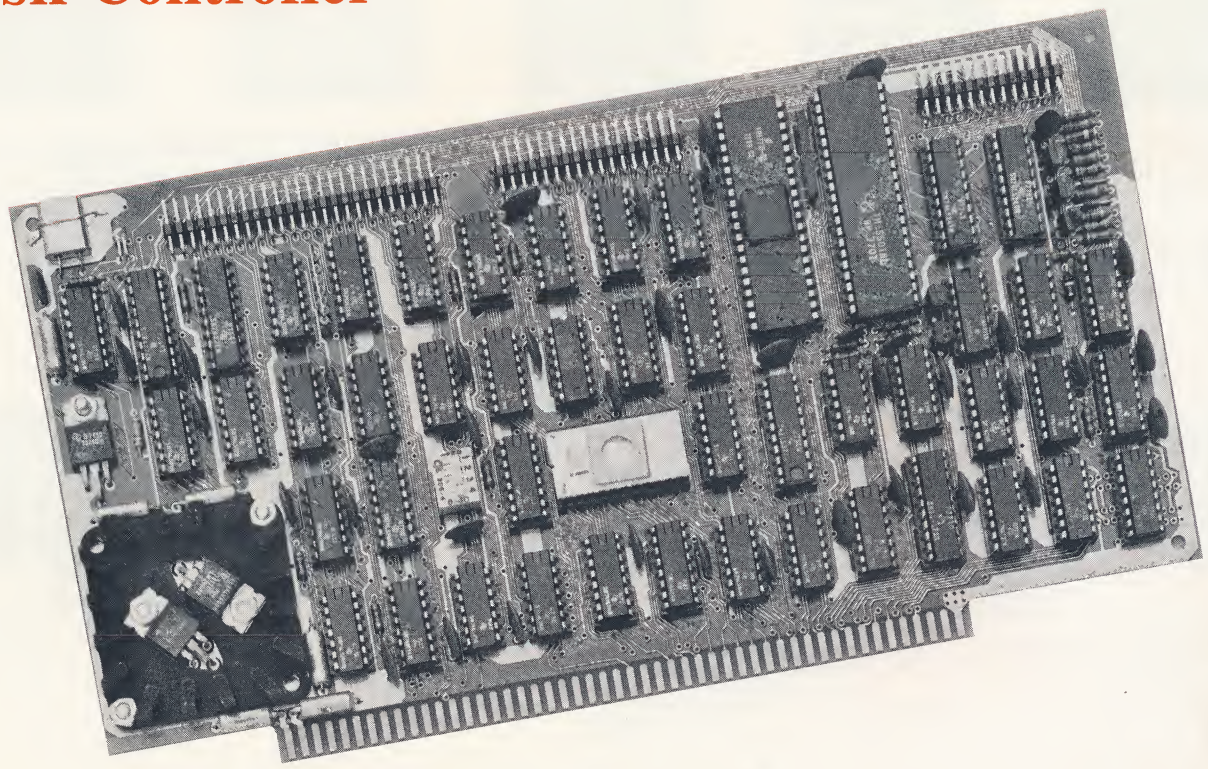
Or order directly by mail on your bank card.

PRICES

TV DAZZLER kit (model CGI-K) $215
TV DAZZLER assembled (model CGI-W) $350
LIFE in full color $15
KALEIDOSCOPE in full color $15

DAZZLE-WRITER (for alphanumeric displays in color) $15
DAZZLE-MATION (for computer-generated animated displays) $15
TIC-TAC-TOE (you play the computer) $15
SPACE WAR $15
4D TIC-TAC-TOE $15
TANK WAR $15
CHASE $15
TRACK $15
DAZZLE-DOODLE $15
GOTCHA $15

Disk Controller



DISK CONTROLLER
- Many functions on one card
- Includes disk bootstrap monitor
- RS-232 interface

SIMULTANEOUSLY INTERFACES UP TO FOUR DISK DRIVES

This card is not only a disk controller but also an I/O interface.

Placing many functions on this one card is possible because we have taken the step of using LSI circuitry.

The card is capable of simultaneously interfacing up to three 5" drives or four 8" drives.

Its interface provisions include an RS-232 serial interface with a baud range up to 76,800 baud.

The bootstrap monitor is contained in a 1K 2708 PROM.

PRICES

Disk Controller card kit (Model 4 FDC-K) $395
Disk Controller card assembled
(Model 4FDC-W). $595

8" DUAL DISK DRIVE

Cromemco also offers a dual Persci floppy disk drive complete with case, power supply and cables to connect to the controller card S-100 bus interface.
Dual 8" Disk Drive kit (Model PFD-K) $1995
Dual 8" Disk Drive assembler
(Model PFD-W). $2495

TECHNICAL SPECIFICATIONS
4FDC DISK CONTROLLER AND I/O INTERFACE

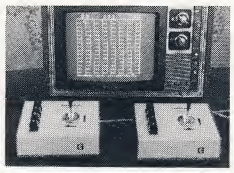
DISK CONTROLLER:
- Maximum number of 5" drives: 3
- Maximum number of 8" drives: 4
- Bootstrap/Monitor firmware: 1K byte PROM
- Controller circuitry: MOS LSI

SERIAL I/O PORT:
- I/O levels: RS-232 or 20 mA current loop
- Low baud range: 110 - 9600 baud (software selectable)
- High baud range: 880 - 76,800 baud (software selectable)

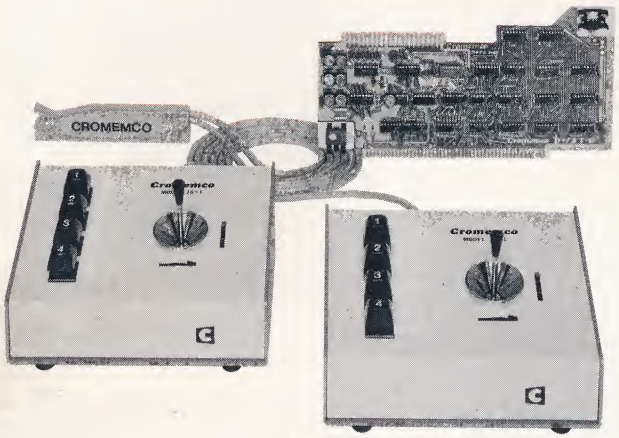
PARALLEL PORT:
- Input port: 8 bits
- Output port: 8 bits
- Input load: one TTL equivalent
- Output drive: 20 TTL loads

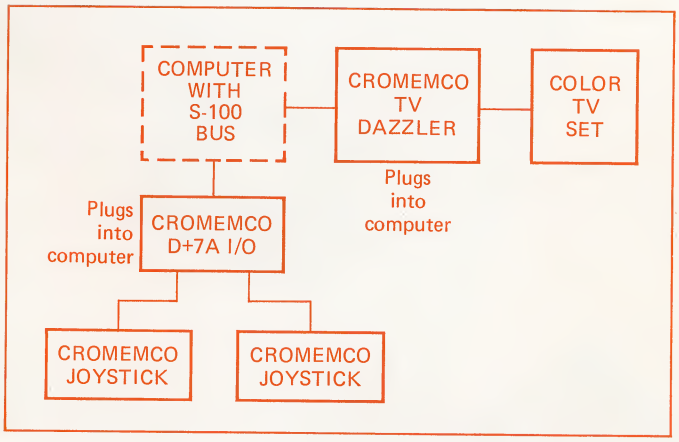
INTERVAL TIMERS:
- Number of timers: 5
- Timer range: 0 -16.32 msec (software selectable)
- Timer resolution: 64 microseconds

GENERAL INFORMATION:
- Disk controller type: 1771-1
- UART type: 5501
- PROM type: 2708
- Bus: S-100 (one slot only)
- Power requirements: +8 volts @ 1.0 A
  +18 volts @ 100 mA
  -18 volts @ 100 mA
- Operating environment: 0 - 55°C



Joystick console with speaker





AND THERE'S AN EASY WAY TO INPUT IT TO YOUR COMPUTER

You'll get a lot more fun out of your computer with this new joystick.

But note that it is not just an ordinary joystick — it is a *console*. It has a 2-axis joystick *and* contains a *speaker* and *speaker amplifier*. You can have *sound* with your games or, say, warning sounds in other applications. Or have your computer talk to you.

Gives you sound, too

Four pushbuttons

A third feature you get is *four pushbutton switches*. These give you even more possible uses such as selecting various colors on a color graphics terminal.

EASY TO COUPLE

To couple the new joystick to your computer, just use our D+7A™ I/O board. It will couple not only one but *two* consoles to your Altair™ 8800 or IMSAI 8080. And you'll still have several analog channels left over (and one 8-bit output port).

The D+7A plugs into the Standard 100 (S-100) bus of your Altair or IMSAI computer.

EASY TO DISPLAY

Displaying the joystick outputs with the software below is also easy. Just use our TV DAZZLER™ board. It also plugs into the S-100 bus.

NEW SOFTWARE

Here's some new Cromemco software for the joystick (to display, use DAZZLER interface):

SPACEWAR (2 players, 2 joysticks): this famous game is available for the first time for a microcomputer.

TANK WAR (2 persons, 2 joysticks): maneuver your tank while firing missiles at your opponent. Sound effects add to the excitement.

CHASE! (2 persons, 2 joysticks): the cross chases the circle.

TRACK (1 person, 1 joystick): move the dot to the center of the spiral without touching the spiral's arms.

DAZZLE DOODLE (1 person, 1 joystick): lets you draw pictures in 4 colors on your color TV terminal using the joystick.

STORE/MAIL

Cromemco wishes you more fun, more use from your computer. Get this new joystick console and other Cromemco peripherals at your computer store or order from the factory.

Joystick console kit (Model JS-1K)	$ 65
Joystick console assembled (Model JS-1W)	$ 95
D+7A I/O kit (Model D+7A-K)	$145
D+7A I/O assembled (Model D+7A-W)	$245
TV DAZZLER kit (Model CGI-K)	$215
TV DAZZLER assembled (Model CGI-W)	$350

SOFTWARE

(Punched paper tape with documentation)

SPACEWAR	$15
CHASE!	$15
TRACK	$15
DAZZLE DOODLE	$15
TANK WAR	$15

TECHNICAL SPECIFICATIONS JS-1 JOYSTICK CONSOLE

JOYSTICK:
- Degrees of freedom: 2 axes (X and Y), spring return to center.
- X axis output voltage: ±2 volts, center 0 volts.
- Y axis output voltage: ±2 volts, center 0 volts.

SWITCHES:
- Number of switches: 4
- Output switch depressed: 0 volts
- Output switch open: +5 volts

AMPLIFIER/SPEAKER:
- Input voltage range: −2.56 to +2.54 volts
- Output: 47-ohm internal speaker

GENERAL INFORMATION:
- S-100 bus interface: use Cromemco D+7A I/O.
- Power requirements: +5 volts @ 50 mA; +18 volts @ 40 mA; −18 volts @ 40 mA
- Operating environment: 0 – 55°C

CROMEMCO Z-2D COMPUTER SYSTEM

This new microcomputer is a thoroughly professional unit for use in engineering, science, production, business, education and other demanding applications.

The Z-2D uses the fast, powerful Z-80 microprocessor and is available with either one or two mini disk drives. These permit extremely fast loading of even large programs and files.

FORTRAN IV and BASIC are available for this computer.

See details in this catalog.

Ordering information

Cromemco's products are sold at computer stores from coast to coast.
Or you can order directly by mail from Cromemco.
Cromemco ships promptly – usually from stock.

- Mastercharge and BankAmericard are accepted with signed order. Please show complete card number and expiration date.
- Mail orders for S-100 bus cards are shipped prepaid if fully paid with order. Computer systems are f.o.b. factory.
- Purchase orders accepted subject to credit approval.
- Shipments to outside U.S. – Payment must accompany order and must include a 10% surcharge to cover additional shipping and handling charges.
- California users add 6% or 6½% sales tax as applicable.

Store prices may be slightly higher to cover stocking costs.

Cromemco
incorporated
Specialists in computers and peripherals
2400 CHARLESTON RD., MOUNTAIN VIEW, CA 94043 • (415) 964-7400